CLAIMS

We claim:

1. A composition comprising

between 0.001 weight percent and 1 weight percent of a vasoactive prostaglandin selected from the group consisting of prostaglandin E_1, prostaglandin E_2, a pharmaceutically acceptable salt thereof, a lower alkyl ester thereof and mixtures thereof, based on the total weight of the composition;

a polymer carrier selected from the group consisting of a medical grade silicone elastomer, a biodegradable polymer and a shear-thinning polymeric thickener;

a lipophilic component selected from the group consisting of a C_1 to C_8 aliphatic alcohol, a C_8 to C_{30} aliphatic ester, a liquid polyol and a mixture thereof;

water; and

a buffer that provides a buffered pH value for the composition of about 3 to about 7.4.

2. The composition of claim 1 wherein the vasoactive prostaglandin is 0.05 to 1 weight percent prostaglandin E_1, based on the total weight of the composition.

3. The composition of claim 1 wherein the polymer carrier is a biodegradable polymer that is flowable at room temperature.

4. The composition of claim 1 wherein the polymer carrier is a biodegradable polymer that is selected from the group consisting of a polylactide, a poly(lactide-co-glycolide), a polyorthoester, a polyphosphazene, a polyanhydrides, and a polyphosphoester.

5. The composition of claim 1 wherein the polymer carrier is a biodegradable polymer that is a biodegradable triblock copolymer selected from the group consisting of a poly(lactide-co-glycolide) - polyethylene glycol - poly(lactide-co-glycolide) copolymer, a polylactide - polyethylene glycol - polylactide copolymer, a polyethylene glycol - poly(lactide-co-glycolide) - polyethylene glycol copolymer and a polyethylene glycol - polylactide - polyethylene glycol copolymer.

6. The composition of claim 1 wherein the polymer carrier is a shear-thinning polymeric thickener that is selected from the group consisting of a shear-thinning polysaccharide gum and a shear-thinning polyacrylic acid polymer.

7. The composition of claim 1 wherein the liquid polyol is a polyethylene glycol selected from the group consisting of polyethylene glycol 200, polyethylene glycol 400 and polyethylene glycol 600.

8. The composition of claim 1 further comprising a penetration enhancer selected from the group consisting of an alkyl-(N-substituted amino) alkanoate, an alkyl-2-(N,N-disubstituted amino) alkanoate, an (N-substituted amino) alkanol alkanoate, an (N,N-disubstituted amino) alkanol alkanoate, pharmaceutically acceptable salts thereof and mixtures thereof.

9. The composition of claim 1 further comprising an emulsifier.

10. The composition of claim 1 further comprising a fragrance.

11. The composition of claim 1 further comprising a topical anesthetic.

12. A method of promoting the recovery of erectile function in a subject after nerve-sparing radical retropubic prostatectomy comprising:

administering during the first post-operative year to the penile meatus of the subject in need of such treatment a topical composition comprising between 0.001 weight percent and 1 weight percent of a vasoactive prostaglandin selected from the group consisting of prostaglandin E_1, prostaglandin E_2, a pharmaceutically acceptable salt thereof, a lower alkyl ester thereof and mixtures thereof, based on the total weight of the composition;

a shear-thinning polymeric thickener selected from the group consisting of a shear-thinning polysaccharide gum and a shear-thinning polyacrylic acid polymer;

a lipophilic component selected from the group consisting of a C_1 to C_8 aliphatic alcohol, a C_8 to C_{30} aliphatic ester,

a liquid polyol and a mixture thereof;

water; and

a buffer that provides a buffered pH value for the composition of about 3 to about 7.4; and

continuing the administration of the topical composition according to a regime of periodic doses.

13. The method of claim 12 wherein the composition further comprises a penetration enhancer selected from the group consisting of an alkyl-(N-substituted amino) alkanoate, an alkyl-2-(N,N-disubstituted amino) alkanoate, an (N-substituted amino) alkanol alkanoate, an (N,N-disubstituted amino) alkanol alkanoate, pharmaceutically acceptable salts thereof and mixtures thereof.

14. The method of claim 12 further comprising the step of placing a drug reservoir in fluid communication with the solution in contact with a cavernous neuron wherein the drug reservoir comprises between 0.001 weight percent and 1 weight percent of a vasoactive prostaglandin selected from the group consisting of prostaglandin E_1, prostaglandin E_2, a pharmaceutically acceptable salt thereof, a lower alkyl ester thereof and mixtures thereof, based on the total weight of the

composition and a polymer carrier that is selected from the group consisting of a medical grade silicone elastomer and a biodegradable polymer.

15. The method of claim 14 wherein the drug reservoir is placed at the time of the prostatectomy.

16. The method of claim 12 wherein the vasoactive prostaglandin is 0.05 to 1 weight percent prostaglandin E_1, based on the total weight of the composition.

17. The method of claim 14 wherein the polymer carrier is a biodegradable polymer that is selected from the group consisting of a polylactide, a poly(lactide-co-glycolide), a polyorthoester, a polyphosphazene, a polyanhydrides, and a polyphosphoester.

18. The method of claim 14 wherein the polymer carrier is a biodegradable polymer that is a biodegradable triblock copolymer selected from the group consisting of a poly(lactide-co-glycolide) - polyethylene glycol - poly(lactide-co-glycolide) copolymer, a polylactide - polyethylene glycol - polylactide copolymer, a polyethylene glycol - poly(lactide-co-glycolide) - polyethylene glycol copolymer and a polyethylene glycol - polylactide - polyethylene glycol copolymer.

19. The method of claim 14 wherein the polymer carrier is a biodegradable polymer that is flowable at room temperature.

20. The method of claim 14 wherein the solution in contact with the cavernous neuron comprises at least 1 micromolar prostaglandin E_1.

21. The method of claim 14 wherein the solution in contact with the cavernous neuron comprises about 1 micromolar to about 30 micromolar prostaglandin E_1.

22. A method of enhancing neurite sprouting from a pelvic ganglion neuron that is nitric oxide synthase positive comprising contacting at least a portion of the neuron with a solution comprising about 1 micromolar to about 100 micromolar of a vasoactive prostaglandin selected from the group consisting of prostaglandin E_1, prostaglandin E_2, a pharmaceutically acceptable salt thereof, a lower alkyl ester thereof and mixtures thereof, based on the total weight of the composition.

23. The method of claim 22 wherein the solution in contact with the nitric oxide synthase positive neuron is in fluid communication with a composition comprising 0.001 weight percent to 1 weight percent of a vasoactive prostaglandin selected from the group consisting of prostaglandin E_1, a pharmaceutically acceptable salt thereof, a lower alkyl ester thereof and mixtures thereof, based on the total weight of the composition and a polymer carrier selected from the group consisting of a medical grade silicone elastomer, a biodegradable polymer and a shear-thinning polymeric thickener.

24. The method of claim 23 wherein the polymer carrier is a shear-thinning polymeric thickener selected from the group consisting of a shear-thinning polysaccharide gum and a shear-thinning polyacrylic acid polymer.

25. A method of promoting the recovery of spontaneous erectile function after nerve-sparing radical retropubic prostatectomy in a subject in need of such treatment comprising the steps of:

administering to the penile meatus a topical composition comprising between 0.001 weight percent and 1 weight percent of a vasoactive prostaglandin selected from the group consisting of prostaglandin E_1, prostaglandin E_2, a pharmaceutically acceptable salt thereof, a lower alkyl ester thereof and mixtures thereof, based on the total weight of the composition;

a shear-thinning polymeric thickener selected from the group consisting of a shear-thinning polysaccharide gum and a shear-thinning polyacrylic acid polymer;

a lipophilic component selected from the group consisting of a C_1 to C_8 aliphatic alcohol, a C_8 to C_{30} aliphatic ester, a liquid polyol and a mixture thereof; water; and

a penetration enhancer selected from the group consisting of an alkyl-(N-substituted amino) alkanoate, an alkyl-2-(N,N-disubstituted amino) alkanoate, an (N-substituted amino) alkanol alkanoate, an (N,N-disubstituted amino) alkanol alkanoate, pharmaceutically acceptable salts thereof and mixtures thereof and a buffer that provides a buffered pH value for the composition of about 3 to about 7.4; and

continuing the administration of the topical composition according to a regime of periodic doses during the first year post-operation.

26. A method for restoring cavernous nerve function in a patient comprising the step of depositing the composition of claim 1 at a site in fluid communication with a cavernous neuron in an amount sufficient to produce an prostaglandin E_1 concentration in the range of at least 1 micromolar in the solution contacting the neuronal cell body, axon or axon terminal of the cavernous neuron for a time period of at least about three days.

27. A method for restoring cavernous nerve function in a patient comprising the step of depositing the composition of claim 1 at a site in fluid communication with a cavernous neuron in an amount sufficient to produce an prostaglandin E_1 concentration in the range of about 10 micromolar to about 30 micromolar in the solution contacting the neuronal cell body, axon or axon terminal of the cavernous neuron for a time period of at least about three days.

28. The method of claim 26 wherein the cavernous neuron is nitric oxide synthase positive.

29. The method of claim 27 wherein the polymer carrier is a shear-thinning polymeric thickener and the site is the *fossa navicularis*.

30. The method of claim 29 wherein the composition further comprises a penetration enhancer selected from the group consisting of an alkyl-(N-substituted amino) alkanoate, an alkyl-2-(N,N-disubstituted amino) alkanoate, an (N-substituted amino) alkanol alkanoate, an (N,N-disubstituted amino) alkanol alkanoate, pharmaceutically acceptable salts thereof and mixtures thereof.

31. A method of treatment of erectile dysfunction associated with prostatectomy, cysto-prostatectomy, radical cystectomy, abdominoperineal resection of the rectum, cryoabalation or radiation therapy comprising the step of placing the composition of claim 1 in a drug reservoir in fluid communication with the solution in contact with a portion of a cavernous neuron.

32. A method of treatment of erectile dysfunction associated with prostatectomy, cysto-prostatectomy, radical cystectomy, abdominoperineal resection of the rectum, cryoabalation or radiation therapy comprising the step of placing the composition of claim 6 in a drug reservoir in fluid communication with the solution in contact with a portion of a cavernous neuron.

33. A method of treatment of erectile dysfunction associated with prostatectomy, cysto-prostatectomy, radical cystectomy, abdominoperineal resection of the rectum, cryoabalation or radiation therapy comprising the step of placing the composition of claim 8 in a drug reservoir in fluid communication with the solution in contact with a portion of a cavernous neuron.

34. A method of treatment of erectile dysfunction associated with neuropathy comprising the step of

administering to the penile meatus of the subject in need of such treatment a topical composition comprising between 0.001 weight percent and 1 weight percent of a vasoactive prostaglandin selected from the group consisting of prostaglandin E_1, prostaglandin E_2, a pharmaceutically acceptable salt thereof, a lower alkyl ester thereof and mixtures thereof, based on the total weight of the composition;

a shear-thinning polymeric thickener selected from the group consisting of a shear-thinning polysaccharide gum and a shear-thinning polyacrylic acid polymer;

a lipophilic component selected from the group consisting of a C_1 to C_8 aliphatic alcohol, a C_8 to C_{30} aliphatic ester,

a liquid polyol and a mixture thereof;

water; and

a buffer that provides a buffered pH value for the composition of about 3 to about 7.4; and

continuing the administration of the topical composition according to a regime of periodic doses.

35. The method of claim 34 wherein the neuropathy is diabetic neuropathy.